



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

# INDEX NUMBERS OF THE TOTAL COST OF LIVING

## SUMMARY

I. The use of index numbers of cost of living stimulated by war conditions, 241. — II. Food prices and cost of living may diverge, 243. — III. A fixed collection of commodities and services forms the basis, 244. — IV. The methods of "proportional" and of "aggregate" expenditure, 246. — The proportional method gives a more correct arithmetical result, 250. — The aggregate method more easily understood, 250. — V. Considerations important in the index number for food, 252. — VI. Index numbers for other groups of articles, 256. — VII. American index numbers are fitted to localities, English are not, 259. — Concluding criticism: the methods of constructing index numbers not adequately explained, 262.

## I

FOR a number of years the bureaus of labor in all the more important industrial countries have published index numbers designed to throw light upon changes in the cost of living. The index numbers of this kind in existence at the outbreak of the war differed among themselves both in the intervals at which changes were calculated and in the groups of expenditure included. In 1914 the United States Bureau of Labor Statistics was compiling a monthly index number of retail food prices.<sup>1</sup> The Board of Trade in England was issuing a similar annual index number. The Canadian Labour Department was maintaining a monthly index number of the cost of food, laundry starch, coal, wood, coal oil and rent. In Australia, the Commonwealth Bureau of Statistics was issuing annually an index number of groceries, food and rent. Similar measures of the cost of

<sup>1</sup> The Bureau also published at intervals the prices of gas and coal, but these prices were not combined to form an index number of fuel and lighting

living were maintained in other countries. None of the index numbers in existence in 1914, however, were well adapted to serve as an element in the determination of wage disputes in a time of rapidly changing prices. The greater part of these index numbers appeared only at considerable intervals — usually a year — and none of them covered the entire cost of living.

As the cost of living increased during the war, and as wage adjustments came more and more under governmental control, the argument that wages should be increased in proportion to the increase in the cost of living figured more and more largely in questions of wage adjustment. It became highly important, therefore, that the extent of the increase in the cost of living should be determined frequently and with as much fullness as circumstances permitted.

The development of the English index number will serve as an illustration of the effect of these considerations. In the autumn of 1914, the Board of Trade began to publish its index number of food prices at more frequent intervals, and it shortly became a monthly index number. In the September, 1915 number of the *Labour Gazette*, the following warning was given:

This figure [the index number of food prices] relates to food only; and in estimating the increased cost of living generally, this increase must not be applied to total family expenditure, but only to that portion which is expended on food. On the whole the increase in other items of working class expenditure has been considerably less, especially as regards rent.

In June, 1916 a new index number which included all groups of expenditure was established. It is a measure of the "average cost of living of the working classes," and has been published monthly since that date.

In the United States the inauguration of the index number of the total cost of living resulted from a clause

in the agreement between the unions in the shipbuilding industry and the Emergency Fleet Corporation, which provided for a reopening of questions of wages, hours or conditions at not less than six months' intervals "provided it can be shown that there has been a general and material increase in the cost of living."<sup>1</sup> The Shipbuilding Labor Adjustment Board, in order that it might be fully informed of the amount of such increases, requested the Bureau of Labor Statistics to collect statistics of changes in the total cost of living. These index numbers as published from time to time in the *Monthly Labor Review* show the changes in the total cost of living at six months' intervals from December, 1914 to June, 1920 in eighteen industrial cities, and from December, 1917 to June, 1920 in thirteen additional cities.<sup>2</sup>

It is likely that the interest in the development of index numbers of the cost of living aroused by the peculiar circumstances surrounding wage adjustment in war time will continue in time of peace — at least until rapid changes in the cost of living have ceased. Professor Irving Fisher in an article published in the *Monthly Labor Review* for November, 1918 advocated the introduction of a sliding scale of wages based on changes in the cost of living, and more recently this plan has been adopted in England in a number of important labor agreements.<sup>3</sup> The Esch-Cummins Act provides

<sup>1</sup> The full text of the clause was as follows: "At any time after six months have elapsed following such ratified agreement, or any such final decision by the Adjustment Board on any question as to wages, hours or conditions in any plant or district, such question may be reopened by the Adjustment Board for adjustment upon the request of a majority of the craft or crafts at such plant affected by such agreement or decision, provided it can be shown that there has been a general and material increase in the cost of living."

<sup>2</sup> Changes in the cost of the "miscellaneous" group of expenditures were not included in the index numbers prior to that for December, 1918. Until then it was assumed that changes in the cost of the items included in the "miscellaneous" group were the same as the average of the changes in the other groups.

<sup>3</sup> For the details of some of these arrangements, see the Labor Gazette, November, 1919, p. 463.

that in fixing the wages of railroad employees, the Labor Board shall take into consideration as one of the elements the relation between wages and the cost of living.

The review of the problems involved in the making of the American and English index numbers of the total cost of living undertaken here is concerned primarily with the use of such index numbers as elements in fixing wages. The consideration of other index numbers of the same kind, brought into existence by the war, has not been attempted, either because the principle on which they are constructed differs from that adopted by the makers of the English and American index numbers, or because the details of their construction have not been sufficiently revealed.<sup>1</sup>

## II

The view has been entertained by some economists that changes in an index number of the total cost of living were likely to correspond fairly closely with changes in the index number of the cost of food.<sup>2</sup> Both the English and American index numbers show, however, that there is frequently a considerable divergence. For example, the index number of food prices for Jacksonville, Florida, for June, 1920 showed an increase of 90 per cent over December, 1914, while the index number for the total cost of living showed an increase of 116 per cent. This is an extreme case, but differences almost as great appear in the same period for other American cities.

So far from its being true that the two kinds of index numbers give identical results, it appears, from both the

<sup>1</sup> Index numbers of the same general character are now maintained in Norway, Denmark and in certain Italian cities

<sup>2</sup> In a paper by Dr I M Rubinow in the *American Economic Review*, vol 1v, pp 793-817 the conclusions as to the movement of real wages are based on the assumption that changes in the index number of food prices coincide with changes in the total cost of living See also, Adams and Sumner, *Labor Problems*, p 512

English and American figures, that food prices advanced much more rapidly during the early part of the war and were only slowly overtaken by the total cost of living. Over considerable periods of time the correspondence between the cost of food and the cost of living is probably closer than over shorter periods. In wage adjustments, however, the periods of time for which knowledge as to price changes is desired are comparatively short, and it is primarily for use in wage adjustments that index numbers of the cost of living are used. Moreover, it is not certain, and will not be until index numbers of the total cost of living have been compiled for a series of years, just how close is the correspondence between food prices and the total cost of living.

### III

In the construction of the English and American index numbers of the total cost of living, the fundamental principle is the same, viz., that the change to be measured is the change in the cost of a collection of commodities and services which shall remain unaltered in quality and amount. The quantity of goods taken as the basis of the calculation is that purchased in the original period. The English and American index numbers are designed, therefore, to show "the average increase in the cost of maintaining the pre-war standard of living of the working class."

With changes in relative prices, changes in the relative amounts of different goods purchased are constantly occurring, but allowance for the effect of such changes are not made in the calculation of these index numbers.<sup>1</sup>

<sup>1</sup> The index numbers of the total cost of living made during the war in Denmark (Copenhagen) and Norway make allowance over certain periods for changes due to changes in relative prices, in the relative amounts of foods consumed. They differ, therefore, in principle from the American and English index numbers

If the changes so occasioned in the relative amounts of different commodities consumed are of sufficient magnitude, the efficacy of the index number as a measure of changes in the cost of living is destroyed, since the sum of satisfactions derived from the amount of money required to purchase the articles in the original list is now greater by an indeterminate amount than the satisfaction yielded by the original list.<sup>1</sup>

On the ground that the "regimen" set up as a standard in an index number of the total cost of living is not sufficiently stable, Mr. G. H. Knibbs, Commonwealth Statistician of Australia, has argued that index numbers of the total cost of living are less satisfactory than index numbers covering a smaller number of expenditure groups. Mr. Knibbs says:

Investigations have proved that the percentage of expenditure on food is far greater in families having small incomes than in those having larger incomes, thus indicating that economies in expenditure are primarily effected in regard to matters other than food. The same is true, but to a less extent, in the case of house rent, while, on the other hand, the relative expenditure on amusements, luxuries, and miscellaneous matters is far greater in the case of families having large incomes. Expenditure on clothing remains at a fairly constant percentage in all families grouped according to income. . . . The effect of changes in prices on cost of living should obviously, therefore, be primarily investigated from the standpoint of those commodities, for which the need is first satisfied, and in regard to which changes in price thus have their full influence on the totality of purchases which can be made with a fixed income. The result is that those items of expenditure which have been excluded from this investigation do not adversely affect the validity and utility of the index numbers computed to show the variation in cost of living due to price-fluctuations. The truth of the matter is that if all branches had been included a fictitious result would have been obtained, since total aggregate expenditure is fixed and does not, in the majority of cases, vary with prices, and, therefore, the distribution of expenditure on luxuries, amusements, etc., does not contribute a substan-

<sup>1</sup> On account of such changes from 1914 to 1918 the English Working Classes Cost of Living Committee decided not to use the "fixed regimen" method and adopted instead the "expenditure" method of measuring changes in the cost of living in England from 1914 to 1918. See Report of the Committee [Cd 8980], 1918.

tially constant regimen, but one which has to be restricted to the surplus available after payment for food, housing accommodation, other necessities, and conventional comforts. . . .<sup>1</sup>

It will be noted that Mr. Knibbs' argument turns on the assumption that "total aggregate expenditure is fixed and does not vary with prices." The use of index numbers of the cost of living in wage disputes rests, of course, on a directly contrary assumption. The question there is: What wage would give the workmen the same standard of living as they enjoyed at some preceding time? Any effect on the "regimen" of an insufficiency in income to purchase the original "regimen" is *ex hypothesi* ruled out. Only changes in the relative amounts purchased due to price divergences affect the validity of the index number.<sup>2</sup> There is no reason to believe that such price divergences are more marked among the expenditure groups taken as a whole than among those included in the Australian index number.<sup>3</sup>

#### IV

In making an index number of the total cost of living the natural order of procedure is, first to construct index numbers of the various groups included in the total cost of living, e. g., food, clothing, etc.; and then to combine these into an index number of the cost of living. For convenience in description, this order will be reversed here, and consideration will be given first to the methods used in combining the group index numbers.

There were two possible methods of combination open to the makers of the English and American index

<sup>1</sup> Report No. 1, Labour and Industrial Branch, Commonwealth Bureau of Census and Statistics, Melbourne, 1912, p. 19.

<sup>2</sup> Rationing may be regarded as an extreme form of price divergence.

<sup>3</sup> In later numbers of the Reports of the Labour and Industrial Branch, Mr. Knibbs does not repeat this argument, but defends the exclusion of certain expenditure groups from the Australian index number on different grounds.



numbers, both of which are in accord with the principles on which these index numbers are based. The group index numbers, representing the cost of purchasing at different dates the standard list of commodities for the groups,<sup>1</sup> might have been left as absolute numbers and merely added together to give the index number of the total cost of living. This method — ordinarily known as the “aggregate” method — is followed in Australia and in Canada in the construction of official measures of the cost of living. The makers of the English and American index numbers chose to follow the other plan — usually known as the “proportional expenditure” method. By this method, the index numbers of the groups are expressed as relatives of the cost of purchasing the group list in the base year, and are combined into a weighted average in which the proportional expenditures on the different groups in the base year are used as the weights.<sup>2</sup>

In considering the relative merits of the aggregate and the proportional expenditure methods, two questions present themselves: (1) whether the arithmetical results are the same, and (2) whether one of the methods is superior on other than arithmetical grounds.

(1) The results of the two methods are identical in result only when in the method of proportional expenditure the weights used are the proportions of expenditure in the base period.<sup>3</sup> The assumption that the thing measured is the change in the cost of a fixed list is en-

<sup>1</sup> If the group index numbers are in relative form, they may, of course, be turned into absolute numbers for combinational purposes, if, as is essential under either method, the proportional expenditures on the groups in the original year are known

<sup>2</sup> The same method has been employed in making most, if not all, of the unofficial index numbers of the cost of living which have been compiled in the United States since the war began. See, for example, *War Time Changes in the Cost of Living*, published in various editions by the Industrial Conference Board

<sup>3</sup> The algebraic proof of this proposition may be conveniently found in W. C. Mitchell, *Index Numbers of Wholesale Prices in the United States and Foreign Countries*, Bulletin of the U. S. Bureau of Labor Statistics No. 173, p. 93. See also, G. H. Knibbs, *Prices, Price Indexes and Cost of Living in Australia*, Report No. 1 of Labour and Industrial Branch, Commonwealth Bureau of Census and Statistics, Appendix, p. xxviii.

tirely consistent with the fact that under either method when prices in one group increase or decrease as a whole relatively to prices in other groups, the proportional expenditures on the different groups increase or decrease proportionately. If, for example, food prices increase more rapidly than the prices in other groups, the proportion spent on food increases. The proportions in which expenditure is actually made on the different groups are, therefore, constantly changing. But under the method of proportionate expenditure the weights used are the proportions in the base year.

In the calculation of the English index number the group indexes are combined into a weighted average by the use of the proportions in which expenditure was made in 1914 on the different groups.<sup>1</sup> The relative importance of expenditure on the groups in 1914, the base year, was not ascertained from a new collection of budgets, but was estimated from various pre-war studies, especially the budgetary study of 1904<sup>2</sup> and the inquiry into the cost of living made in 1912. The considerations which governed in making modifications in the proportions of expenditure which had been ascertained for most of the groups a considerable number of years prior to 1914 were of the most general character. The proportions finally adopted vary only slightly from the proportions which were found by the study of 1904.

The procedure followed by the Bureau of Labor Statistics was more exact. In each of the cities for which the change in the cost of living was to be calculated, budgetary studies were made in order to ascertain the proportionate expenditure on the groups. This

<sup>1</sup> "In order to arrive at a single figure representing the increase since July, 1914 in the prices of all the items taken together, the average percentage increases under each of the main groups of expenditure referred to above are combined in accordance with their estimated relative importance in average pre-war working class expenditure" *Labour Gazette*, March, 1920, p. 119

<sup>2</sup> *British and Foreign Trade and Industry* [Cd. 2337], 1904, pp. 1-75.

information was collected late in 1917 and early in 1918 for the year preceding the date of the inquiry. The Bureau, therefore, had in hand data as to proportional expenditure far superior to that possessed by the makers of the English index number. In constructing the index number of the total cost of living, however, the Bureau weighted the group index relatives on the 1914 base by the proportions of expenditure found for the year 1917.<sup>1</sup>

An element of error that varies for each city and for each period was thus introduced.<sup>2</sup> The extent of the error at any given date depends upon two factors: (1) the degree of the divergence in changes in the index numbers of the different groups, and (2) the extent to which a group that diverges in price is weighted. The maximum error occurs, therefore, where a heavily-weighted group shows a large divergence in price change from other groups.<sup>3</sup> The index number of the total cost of living is likely to be affected in larger degree by an error in weighting of this kind than other index numbers, as the food expenditure group forms such a large part of total expenditure. Since the price of food in the United States advanced from 1914 to 1917 more rapidly than the prices of other groups, the proportion spent for food in 1917 was greater than in 1914. Any other assumption violates the principle on which such index numbers are based. By using the 1917 proportions on the 1914 prices

<sup>1</sup> The procedure followed in constructing the index number for Philadelphia, which may be taken as typical, was described in the *Monthly Review* for March, 1918 as follows: "Schedules covering in detail the income and expenditure for the year 1917 of 512 families were secured . . . The total increase is a weighted average obtained by multiplying the percentage increase in the retail prices from 1914 to 1917 by the percentage of expenditure item by item in 1917 "

<sup>2</sup> It may be noted that exactly the same error was formerly made by the Bureau in calculating its index number of food prices. The relative prices, with base 1890-99, were multiplied by figures which represented the relative importance of expenditure in 1901 — a method which assumed that the proportionate expenditure remained unaltered until 1901. See *Bulletin of the Bureau of Labor Statistics* No. 156, pp. 360, 361.

<sup>3</sup> For an error in weighting of similar kind, see J. M. Keynes, "Rents, Prices and Wages," *Economic Journal*, vol. xvin, pp. 272, 655.

as a base, therefore, the increase in the index number of the total cost of living was made greater than it would have been with the use of proper weights. The increase in the cost of living was thus exaggerated.<sup>1</sup>

In the latter part of 1918 the Bureau made a new study of the cost of living in a large number of American cities, in the course of which the proportionate group expenditures for the year preceding the date of the study were ascertained. These proportions were used as weights to calculate the index numbers of the total cost of living for December, 1919 and June, 1920.<sup>2</sup> The preceding index numbers were not, however, recalculated with the new weights. The series as it stands at present, therefore, is an average of group relatives on a 1914 base, weighted in the earlier part by proportionate expenditure as found for the year 1917, and in the later part by proportionate expenditure as found for the year 1917-18.

Even, however, when the weighting is proper, the aggregate and the proportional expenditure methods give arithmetically identical results only if all the items in each of the great divisions of the cost of living are included in the calculation. The budget for each group must be complete. In the case of rent there is no difficulty since rent is a single indivisible item. But in the other groups it is not possible to include all the items in the group indexes, because either the amount or the price of the omitted commodities cannot be ascertained. It is far more feasible to determine the proportional part of the total expenditure which goes for food, for example, than it is to ascertain the quantity pur-

<sup>1</sup> As a test of the amount of error involved, the first of the index numbers calculated by the Bureau — that for Philadelphia — may be taken. The increase in the total cost of living in Philadelphia from 1914 to 1917 according to the Bureau's calculation was 43.81 per cent, with proper weighting it was slightly less than forty per cent.

<sup>2</sup> No notice has been given of this change, except that the new weights are printed in the tables for December, 1919 and June, 1920.

chased in the base year and the prices over a series of months or years of all the items entering into the food budget.

By the aggregate expenditure method, therefore, the cost of living is determined by adding together the cost of a series of items not fully inclusive. The assumption is that on the average the missing items will vary in price as the index number of those included. In the method of proportional expenditure, the assumption is that the missing items will vary in price as the other items in the same group, that is, that food items not included will vary as the index number of the food items included. It is probable that omitted items will vary in price more nearly in accordance with the index number of the group to which they belong than with the index number of the total cost of living. The advantage in this respect is, therefore, with the method of proportional expenditure. As long as the available information is so incomplete that the price changes of only a part of the items can be ascertained, the proportional expenditure method gives a more nearly correct arithmetical result.

(2) Judged by other than arithmetical standards, the superiority of the aggregate method is undoubted. Since the chief practical use of the index number of the total cost of living is to serve as one of the elements in the determination of wages, it is highly desirable that the method of calculation should be easily understood. In this respect the aggregate method is far preferable. The proportional expenditure method requires for its understanding a knowledge of arithmetical processes which is not possessed by the majority of those whose wages are determined by changes in the cost of living.<sup>1</sup>

<sup>1</sup> During the war the Division of Information of the Department of Labor issued placards explaining the method used by the Bureau of Labor Statistics, but it is doubtful whether a mere understanding of the arithmetical processes was efficacious in giving a knowledge of the principle on which the index number was constructed

On the other hand, the aggregate method is easily understood by any one who can add. Moreover, the principle underlying the two methods — the ascertainment of changes in the sum of the prices of a fixed body of commodities — is grasped at once from the processes of the aggregate method, while the use of weights and relatives in the method of proportional expenditure tends to obscure from those not trained in arithmetical processes the principle on which the calculation is made.

## V

Articles of food constitute the most important group of commodities included in the index number of the total cost of living. In the English index number it is reckoned that 60 per cent of expenditure is for food, while in the American index numbers, food constitutes in different cities from 35 to 45 per cent of total expenditure. In the construction of an index number of food prices, the more important considerations relate to (1) the character of the budgetary basis, (2) the averaging of prices obtained from dealers, and (3) the combination of these prices into an index number of food prices.

(1) The English index number of food prices is based, with certain modifications, on the collection of budgets of urban working class families gathered by the Board of Trade in 1904.<sup>1</sup> The U. S. Bureau of Labor Statistics weights its index number of food prices by means of data collected in 1901.<sup>2</sup> The English index number is weighted by the proportionate expenditure method, while the American number is an aggregate and is, therefore, weighted by the absolute amounts of the articles consumed. The chief question raised in this

<sup>1</sup> The Labour Gazette, March, 1920, p. 2

<sup>2</sup> Cost of Living and Food Prices, Thirteenth Annual Report of the Commissioner of Labor, 1913.

connection is whether in either case the weights used are proper weights, in view of the considerable period which has elapsed since the inquiries on which they are based were made.

The makers of the English index number defend the use of the 1904 weights by the following argument:

The adoption of "weights" based on the expenditure of 1904 was not invalidated by changes in quantities between 1904 and 1914, because the changes in quantity, which were generally slight, were largely counterbalanced by changes in price level, with the results that the proportions of income spent on the different commodities could not have been sensibly altered, except as regards margarine for which a special allowance was made.<sup>1</sup>

The evidence for the statement that changes in quantity were generally slight is not given, but consists presumably of export, import and production statistics.<sup>2</sup>

In the United States the Bureau of Labor Statistics used as weights, without change, the quantities of the articles of food consumed in 1901. The only available information as to working men's dietaries comparable in extent with that collected in 1901 is to be found in the analysis made by the Bureau of the budgets of shipyard workers collected in 1917-18,<sup>3</sup> and in the results of the 1918 cost of living investigation of the Bureau.<sup>4</sup> It appears from both these investigations that a very considerable change in diet had occurred between 1901 and 1917-18. There was a marked reduction, for example, in the consumption of all kinds of meats. The question

<sup>1</sup> The Labour Gazette, March, 1920, p. 2

<sup>2</sup> The Working Classes Cost of Living Committee, 1918, which reached the same conclusion, said "Between 1904 and 1914 no public investigation of the cost of living was set on foot in this country, but a considerable number of budgets were collected in limited areas by various private enquirers. It is fairly certain, from analysis of the production, imports and exports of staple foods, that during this decade no considerable changes took place in the standard of living and published statistics as to the course of prices and similar matters afforded us trustworthy checks. Report of Committee [Cd. 8980], 1918, p. 4

<sup>3</sup> Monthly Labor Review, December, 1918, pp. 115-146

<sup>4</sup> Ibid., July, 1920, pp. 1-10.

may be raised whether these changes were an effect of war conditions or due to more permanent causes. It is extremely improbable, however, that such important changes were entirely or even largely due to the war. The investigations of the English Working Classes Cost of Living Committee show far less important changes in English working class dietary between 1914 and 1918. There seems to be strong reason to believe that the food budget of 1901 was not a correct budget for 1914.

Whether the use of the 1901 budget has affected materially the arithmetical result is more doubtful. The movement of retail food prices from 1914 to 1920 in the United States has not been characterized by such disproportionate increases in the prices of certain food products as have occurred during the same period in England, and the character of the budget used as a base is therefore arithmetically less important. There have been, however, notable cases of inequalities in price changes among different food articles, and all uncertainty should be removed at the earliest practicable time by the adoption of a modernized food budget,<sup>1</sup> and the recalculation of the index number of food prices.

(2) The construction of index numbers of retail prices involves one process — the ascertaining of average prices for each article — that does not concern to anything like the same degree the maker of indexes of wholesale prices. Retail prices must be gathered from many dealers and averaged, since there are no single market prices. The method pursued by the makers of the English index number is to have local officers obtain

<sup>1</sup> In December, 1918, Commissioner Meeker said: "There was no time to calculate new weights based on the quantities of each article consumed in the average workman's family today, so the old and rather imperfect weights used in the 1901 study had to be used. We can and ought to revise these weights, using the facts as to family consumption we are finding in the present study." *Proceedings, American Economic Association*, 1918, p. 110. Two years have elapsed since this statement was made, but the same food budget is still used by the Bureau.



from merchants in each locality prices of the various food articles, and "forward statements showing for each article of food included the predominant price at the current date, and the amount of the change in such prices since the previous report."<sup>1</sup> These prices are then averaged by taking an unweighted arithmetic mean separately for towns under 50,000 and for towns of 50,000 and over. The percentage increase in the price of each article as against July, 1914 is then calculated for each class of towns. The arithmetic mean of these percentages gives the increase for the United Kingdom. In making its averages of local food prices, the Bureau of Labor Statistics uses quotations only from local merchants who made quotations at both the dates which are being compared. An arithmetic average of the actual prices is made.

Both in England and the United States, it will be noted, the attention of the index number makers has been directed primarily to guarding against the possible insufficiency of the price samples. The difficulty lies in the fact that quotations can be secured from only a small part of the merchants and there is no knowledge of the relative amounts sold by each. What is really desired is the change in the average price, for example, of sugar, and to get this with certainty it is necessary to know the total number of pounds of sugar sold at the two dates and the total sums received for sugar. If these facts could be ascertained in full, the average prices at the two dates would also give the price change. But since such complete information is unobtainable, the inquirer must fall back on some system of sampling.

In the use of the predominant price, the theory presumably is that the predominant price is a better indi-

<sup>1</sup> The average prices of commodities other than food are not ascertained by the "predominant price" method, but either by the "identical firm" method, or by merely averaging the prices received from a number of retailers

cation of the average price than an average of the prices collected. This is, of course, to assume that such price changes conform to a definite form of grouping. The device of the "identical firm" is based on the theory that samples of changes are more trustworthy than the same number of samples of prices. Whether these methods do give different and better results than would be given by arithmetic averages of ordinary samples cannot be judged, since data are not available. There is great need of experimental inquiries into the subject of the kind that Professor W. C. Mitchell has made in the kindred field of wholesale prices.

(3) The combination of the prices, average or pre-dominant, into an index number of food prices raises questions of the same kind as have previously been discussed. In the English index number the average prices are turned into relatives on a 1914 base and then combined into a single number for food prices by using the figures for proportional expenditure as found by the 1904 inquiry. In the United States, the average prices of food are multiplied by the quantity found by the 1901 inquiry. As has been pointed out above, the two methods give the same arithmetical result. Unfortunately, altho the American index of food prices in construction is an aggregate, it is not published as such, but is converted into a relative before publication.

## VI

In the construction of index numbers for the groups of expenditure other than food — clothing, fuel and light, etc.<sup>1</sup> — the most important difference between the

<sup>1</sup> It is impossible to compare the methods used in the construction of the index numbers for rent. No information on that point is contained in the publications of the Bureau of Labor Statistics, and in England on account of the Increase of Rents Restriction Act, which limited the increase in rents to an amount equivalent to the increase in rates, the methods employed in estimating rent increases have not been comparable with those suitable under other conditions.

American and English index numbers is in the methods used in combining the average prices of commodities into group index numbers. The Bureau of Labor Statistics combines the average prices of the articles included in the groups into group index numbers by the so-called "unweighted" method, while the English group index numbers are weighted according to proportionate expenditure in 1914. The weights used are in some cases very rough, and lack a satisfactory basis in budgetary study.

In a paper read before the American Economic Association in 1918, Dr. Royal Meeker, Commissioner of Labor Statistics, said:

Except for articles of food, the individual items of consumption are not weighted within each group or class, according to their importance in the family budget. In the clothing group, for instance, suits, night shirts, socks, caps, shoes, neckties, shirts and handkerchiefs all have equal weight. Quite possibly weighting within the groups will not change the percentage change in cost of the groups as wholes, but we have no ground for assuming this to be the case. To be sure, all experience has shown that it makes but little difference what methods are used in computing an index number. However, science, common sense and expediency all require the extension of the weighting of individual items to all groups of the family budget.<sup>1</sup>

It is not clear from this description exactly how the combination into an index number is made. There is, of course, no such thing as an "unweighted" index number and, presumably, one of two methods was followed. Either the price of one suit of clothes, of one collar, of one pair of socks, etc., were added together and divided by the number of articles, in which case it was assumed that the consumer purchased one of each article; or the price of each article in 1914 was called 100, the relative prices computed for succeeding years, and the sum of the relatives divided by the number of items, in which case

<sup>1</sup> American Economic Review, March, 1919, Supplement, p 110

it was assumed that consumers spent in 1914 equal sums on each of the articles.

In the absence of information as to what articles are included in the group index numbers or as to the prices of these articles, it is impossible to verify the suggestion of the Commissioner that weighting might not affect the result. There is one piece of evidence, however, that points — so far as clothing prices are concerned — in a contrary direction. The National Industrial Conference Board has compiled an index number of the movement in the cost of living since July, 1914. In this index number the increase in the price of clothing is calculated by the use of weights based on clothing budgets. The increase in the Board's index number for clothing from July, 1914 to November, 1919 for the United States as a whole was 135 per cent, while the median of the increases in the eighteen cities covered by the Bureau of Labor Statistics from December, 1914 to December, 1919 was 175 per cent. The dates are not exactly comparable, but sufficiently so; for we know that there was little or no increase in clothing prices before December, 1914 and the ends of the periods nearly coincide.

Entirely apart from the question of arithmetical result, it is desirable on other grounds that cost-of-living index numbers should be deliberately weighted. It would be a sufficient justification for using the "un-weighted" method in making an index number of wholesale prices, if it could be shown that identical results were secured by the two methods, since no one has an immediate monetary interest in such index numbers. But the case is different with index numbers of the cost of living. Here the interest is immediate and mere identity of result is not sufficient to justify the use of a method which does not commend itself to the untutored intelligence of the parties concerned. Even the

crudest system of deliberate weighting is superior to the unconscious weighting involved in "unweighted" index numbers.

## VII

It is a fundamental principle of index numbers of the cost of living that the more closely the weights and prices are related to a particular place the more exactly they represent changes in the cost of living of persons living in that place. It follows that the most desirable index number for a particular place is one made from local prices and weighted throughout according to local consumption. The English and American index numbers differ markedly in that the English index number is calculated for the country as a whole, while the American index numbers are city indexes.

The group weights, the weights given articles within the groups, and the prices in the English index number, are averages for the whole country. The predominant prices of food articles are averaged for two classes of cities and these averages are then combined to give an average price for the country. The index numbers for other groups are made directly from dealers' quotations, the prices secured from all dealers being averaged without regard to location.<sup>1</sup> Prices and working-class consumption probably differ less from place to place in England than in the United States, and a single index number made in this manner, therefore, represents changes in the cost of living more accurately for any one city than it would in the United States.

<sup>1</sup> The following statement for fuel and light illustrates the method employed "The items included in this group are coal, gas, oil, candles, and matches. Statements are obtained each month from correspondents as to the prices of coal in 30 of the principal towns and of gas in 26 of the principal towns. Returns as to the prices of oil, candles, and matches are obtained each month from retailers in 28 of the principal towns. The prices quoted are tabulated and scrutinized, and an average price is then arrived at by totalling the quotations and dividing by the number of entries." *Labour Gazette*, March, 1920, p. 119.

Altho the American index numbers are nominally city index numbers, they are only partially fitted to local conditions.<sup>1</sup> The proportions of income expended on the different groups are ascertained for each locality included, and the importance of each group of expenditures is weighted for each city in accordance with local expenditure. The prices used are averages of local dealers' prices.<sup>2</sup> But the weights given articles within the groups are not based on local consumption. In the food group, presumably, altho no explicit statement to this effect can be cited, the weights used are those found for the district in which the city is located by the inquiry made in 1901. The other expenditure groups are "unweighted," that is, the weighting is the same in Los Angeles as in New York. There are great differences among American cities in the relative amounts spent on the articles in each of these groups. Great variations exist in the proportions, for example, in which various kinds of coal, gas, oil and wood are used as fuel. But of these differences the city index numbers as now constructed take no account.

Index numbers fitted to local conditions have also an important advantage in construction. A prime problem in index numbers of the total cost of living lies in the difficulty in certain expenditure groups in finding standardized and identifiable commodities which shall be uniform throughout the area covered. In the food group, this problem is not incapable of solution, but in the other groups the solution is never completely satisfactory. The smaller the area for which the index number is calculated, the less is the difficulty presented, since

<sup>1</sup> Tho not completely local, the American city index numbers show wide differences in fluctuations. In June, 1920, for example, the increase in the cost of living over December, 1914 was 136 per cent in Detroit as against 96 per cent in San Francisco and Oakland.

<sup>2</sup> Monthly Labor Review, August, 1918, p. 135.

the qualities of the articles vary less and it is more practicable to fix on some one grade as predominant. For example, altho in the United States as a whole numerous kinds of coal are used as fuel, in any particular city the number of kinds and qualities is very much less.

The making of separate index numbers for a number of cities involves, of course, a study of budgets in each of the cities and, therefore, requires a larger amount of preliminary work than would be required for the making of a national budget. It seems probable, however, that a much smaller number of budgets than has heretofore been used in the United States would be scientifically sufficient as a basis for satisfactory consumption weights. In the great inquiry of 1901, the Bureau of Labor collected 25,448 budgets; the Report of the English Working Classes Cost of Living Committee, which covers much the same ground so far as our present interest is concerned, is based on 971 budgets. Calculations of the "standard deviations" of several groups of budgets were made for the Committee and it appears that the "standard deviation" for a group of 100 budgets was 3 per cent and for the whole group of 971 budgets only 1 per cent of the average expenditure for food.<sup>1</sup>

From local index numbers it is possible to form national index numbers which would be superior to national index numbers that are computed on the basis of national averages of prices and consumption. An average of the changes in the cost of living in the different cities, weighted by the population of each city, would give the average change for the country in the cost of

<sup>1</sup> Report of Working Classes Cost of Living Committee [Cd 8980], 1918, pp 14, 15. Five hundred and seventy-one budgets were gathered by the Bureau of Labor Statistics for Philadelphia alone. It would be interesting to know how the Bureau decides on the necessary number of budgets.

living in the sense in which it is used by the ordinary man and in wage adjustments. In the October, 1920 number of the *Monthly Labor Review* the Bureau of Labor Statistics presents for the first time a national index number of the total cost of living. Unfortunately almost all the advantages of already having local numbers are lost in the method of combination adopted. The percentage increases in the different cities for each group of expenditure are averaged, and these are combined into an index number by the use of weights of proportionate expenditure secured by averaging the proportions of expenditure in the cities. An index number is thus constructed on the assumption that the proportionate expenditure on the groups and within the groups is the same in all the cities.

In conclusion, one important criticism of these index numbers may be offered. As has been noted at various points in the foregoing discussion, the methods employed in the construction of the American index number have never been set forth fully in any official description. They must be inferred chiefly from papers read by the Commissioner and from descriptions published some years since of the method of constructing the index number of food prices. Even with these aids many points are still obscure. Just what articles of clothing, for example, are included and whether they are combined by an average of actual prices or of relatives remains uncertain. Again, we are not told what articles are included in the index number of fuel and lighting. The information as to the English index number is far more satisfactory. The description in the *Labour Gazette* for March, 1920, the only source of detailed information, was not published, however, until three years after the first appearance of the index number.



During that period, an index number which was much used in the adjustment of wages had to be taken on faith.<sup>1</sup> Moreover, the present information is by no means entirely satisfactory. For example, in the account of the methods followed in making the group index number for "other items" the *Gazette* says: "The increases so ascertained for each item have been combined, after consideration of the relative importance of the different items, so as to enable the Department to form an estimate of the average increase of these items taken as a whole and its effect on the general percentage increase for all items." But what is the "relative importance given to these items?"<sup>2</sup>

GEORGE E. BARNETT.

JOHNS HOPKINS UNIVERSITY.

<sup>1</sup> The old form of explanation is exemplified in the following extract from the March, 1919 number of the Labour Gazette: "The average level of rents has only increased very slightly (as a result of increases in local rates), but the prices of other items have advanced so substantially that the general increase in the prices of all the items ordinarily entering into the working class family budget (including food, rent, clothing, fuel and light, etc.) between July, 1914 and March 3, 1919 is estimated at 115 per cent, taking for this calculation the same quantities, and, as far as possible, the same qualities of the various items in March, 1919 as in July, 1914. If the amount of increased taxation on commodities is deducted the increase is about 7 per cent less."

<sup>2</sup> The recent British Empire Statistical Conference adopted the following recommendation: "That in all cases in which an Index-Number is first issued or revised by a Government Department, it should be accompanied by a statement of the methods employed and the data used in its construction, giving sufficient detail to permit of its reconstruction by a reader. . . ."